COMMUNICATION DEVICE

FIELD OF THE INVENTION

5   The present invention relates to a communication device, and in
particular, to a modem which is suited for use in a communication device
which carries out xDSL (x Digital Subscriber Line) type communication.
Here, x collectively represents A, H, S, V and the like.

BACKGROUND OF THE INVENTION

10   Currently, much attention is focussed on communication systems
such as A (Asymmetric) DSL, S (Symmetric) DSL, V (Very high speed) DSL,
H (High speed) DSL, and the like, as methods for carrying out data
communication by using telephone lines. Accompanying this trend,
research and development are being carried out on carrying out data
15   communication simultaneously at the same line, while using even
conventional telephones. When data is multiplexed with a telephone,
in order for conventional telephone service to not be adversely affected,
it is necessary to carry out design for the xDSL modem while paying very
close attention. It is desirable to reliably carry out telephone
20   service even if some functions must be sacrificed.

        On the other hand, in a case in which telephone service is not
needed, it is desirable to carry out communication faster. In this case,
when using an xDSL modem which is the same as in the case when multiplexed
with telephone service, useless frequency space arises, which is not
25   efficient. The reasons for this are described hereinafter.

        Namely, when telephone service and data communication service are
multiplexed on the same line, the line capacity of the modem is specified
by recommendation. For example, in ITU-T Recommended G.992.1 Annex E,
the line capacity is specified to be 35 nF, and the cut-off frequency
30   is 45 KHz. In contrast, with data communication which is not

multiplexed with telephone service, there is no such stipulation. However, when a cut-off frequency of 45 KHz is applied as is to data communication which is not multiplexed with telephone service, the band in a region lower than 45 KHz cannot be utilized, which is inefficient.

5   Fig. 4 is a structural diagram of a case in which telephone service and data communication service are multiplexed on the same telephone line. Fig. 5 is a structural view of a case in which communication service is not multiplexed with telephone service. In Fig. 4, a data terminal 16 is connected to a telephone line 13 via an xDSL modem 15

10   and a branching filter 14. Further, a telephone 19 is also connected to the telephone line 13 via the branching filter 14.

The telephone line 13 is connected to a data network 10 via a branching filter 12 and an xDSL modem 11 in a station of a communication provider. Further, the telephone line 13 is connected to a public

15   network 17 via the branching filter 12 and an exchanger 18. In the case illustrated in Fig. 4 in which data communication service and telephone service are multiplexed, the line capacities of the modems 11, 15 are 35 nF, in accordance with the previously-mentioned ITU-T recommendation. Therefore, the cut-off frequency for communication data is 45 KHz.

20   On the other hand, in the case shown in Fig. 5 in which data communication service is not multiplexed with telephone service, a data terminal 24 is connected to a telephone line 22 via an xDSL modem 23, and the telephone line 23 is connected to a data network 20 via an xDSL modem 21 at a station of the communication provider. Also in Fig. 5,

25   in a case in which the aforementioned specified 35nF is used as the line capacities of the modems 21, 23, the cut-off frequency must be 45 KHz. Therefore, regardless of the fact that data communication service is not multiplexed with telephone service, the use of the band in a region lower than 45 KHz is limited, which is inefficient.

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Therefore, conventionally, a technique has been used in which two different types of modems are used, i.e., the modem of the type used for the system of Fig. 4 and the modem used for the system of Fig. 5, and the appropriate modem is used in accordance with the system, which
5 is also inefficient.

SUMMARY OF THE INVENTION

The present invention relates to a communication device which is
10 efficient and in which automatic setting of a cut-off frequency at a communication line is possible.

In accordance with the present invention, there is provided a communication device comprising: cut-off frequency switching means for switching a cut-off frequency for communication data at a communication
15 line. The cut-off frequency switching means is structured to carry out switching of a D.C. cut-off capacitor.

Further, the communication device further comprises: confirming means for confirming whether or not a communication partner has the cut-off frequency switching means, in advance of sending and receiving
20 of communication data. The confirming means is structured such that switching control of the cut-off frequency switching means is carried out in accordance with results of confirmation. The communication line is a telephone line, and the communication device is a modem. xDSL (x Digital Subscriber Line) type communication, which carries out data
25 communication via the telephone line, is carried out.

Operation of the present invention will be described. The present invention is structured such that a cut-off frequency for communication data at a communication line is automatically switched. Thus, information transmission in a frequency space of a broader range

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is possible.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a schematic structural diagram of an embodiment of the

5   present invention.

Fig. 2 is a circuit diagram which illustrates an example of a D.C.

cut-off circuit of Fig. 1.

Fig. 3 is a flowchart which shows operation of the embodiment of

the present invention.

10   Fig. 4 is a diagram which shows a system structure in a case in

which telephone service using a telephone line and data communication

service are multiplexed.

Fig. 5 is a diagram which shows a system structure in a case of

only data communication service using a telephone line.

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DESCRIPTION OF THE PREFERRED EMBODIMENTS

Hereinafter, an embodiment of the present invention will be

described with reference to the drawings. Fig. 1 is a schematic block

diagram of an xDSL modem in accordance with an embodiment of the present

20   invention. In Fig. 1, a modem 4 in accordance with the present invention

has a D.C. cut-off circuit 1, and a DSP (digital signal processor) 2

having a D/A (digital/analog) conversion function and an A/D

(analog/digital) conversion function. The DSP 2 is connected to a data

network or terminal, and communication can be carried out thereat by

25   a transmission method which is suited for a terminal or a network.

The D.C. cut-off circuit 1 is a four terminal network circuit

structure. A concrete example thereof is illustrated in Fig. 2. Among

the four terminals, two terminals are connected to terminals of a Tip

and a Ring, and the other two terminals are connected to the DSP 2.

Referring to Fig. 2, the D.C. cut-off circuit 1 is structured by a
transistor 6, capacitors 7, 9, and a switch 8. The primary side of the
transistor 6 is connected to terminals of the Tip and the Ring. A
parallel circuit of the capacitor 9 and a D.C. connection circuit of

5 the capacitor 7 and the switch 8 is provided at the primary side of the
transistor 6. The parallel circuit is inserted in series with a primary
winding.

The DSP portion 2 shown in Fig. 1 has the original communication
function for carrying out communication between a network and a terminal,

10 as well as has a function for carrying out giving and receiving of
communication parameters with a modem, which is a communication partner
thereof, in accordance with a protocol which is determined in advance.

Fig. 3 is a flowchart for explaining operation of the embodiment
of the present invention. In response to a request to start

15 communication (step S1), control is carried out to open the switch 8
of Fig. 2 (step S2). A state is set in which there is only connection
with the capacitor 9 which is 35 nF, which is the line capacity prescribed
for a case of multiplexing with telephone service. In this state,
communication is carried out to effect giving and receiving of

20 communication parameters with the modem which is the communication
partner (step S3). In the structure of Fig. 4, exchange of
communication parameters is carried out between a modem 15 and a modem
11. In the structure of Fig. 5, exchange of communication parameters
is carried out between a modem 21 and a modem 23.

25 One of the parameters in this case may be whether there is the
switch 8 or not. Namely, information is included which expresses
whether or not there is a mechanism for switching the line capacity.
Or, information is included which expresses whether or not a
communication system is multiplexed with telephone service. If the

partner modem does not have a switching mechanism (step S4),
communication is carried out (step S7) with the switch 8 maintained in
the open state. (This corresponds to the case of Fig. 4.)

5   In contrast, in a case in which the partner modem has a switching
mechanism (step S4) and the communication system is not a multiplexing
system (step S5), the switch 8 is closed (short) (step S6), and the line
capacity between the Tip and the Ring is made to be a parallel connection
of the capacitors 7 and 9, for example, is switched to a total capacity
of $1\mu F$. In this way, the cut-off frequency of the data communication
10   is changed from 45 KHz to 1.6 KHz, and communication in a lower region
is possible (step S7). (This corresponds to the case of Fig. 5.) Further,
even if the partner modem has a switching mechanism, in the case of a
multiplex communication system (step S5), the switch 8 is not switched,
and is kept open. (This corresponds to the case of Fig. 4.)

15   Further, the information as to whether there is a multiplex
communication system or not is set in the communication parameter which
is transmitted by the modem 11 or 21 at the station. Therefore, it is
possible for the modem 15 or 23 at the terminal side to know this
information.

20   In this way, in the case in which there is not a multiplex
communication system, the cut-off frequency of communication data at
the communication line of the D.C. cut-off circuit 1 is changed from
45 KHz to 1.6 KHz. Data communication in a wider band is thereby
possible between terminals and networks.

25   Further, the circuit diagram which is illustrated in Fig. 2 is
merely an example, and it should be clear that various modifications
are possible. Moreover, the circuit may have a digital filter
structure.

As described above, in accordance with the present invention,

before data communication is carried out, the presence/absence of a
switching mechanism of the partner and the form of the current
communication system are confirmed, and control is carried out to
automatically switch the cut-off frequency. As a result, there is the

5   effect that, even if the user does not know the structure of the modem
or the like of the partner, optimal and efficient communication is
possible. Moreover, there is no need to ready a different type of modem
depending on whether or not telephone service and data communication
service are multiplexed. Thus, there is the effect that this also is

10   efficient.